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(12) (19) (CA) **Demande-Application**

(21) (A1) **2,313,933**
(22) 2000/07/14
(43) 2001/01/20

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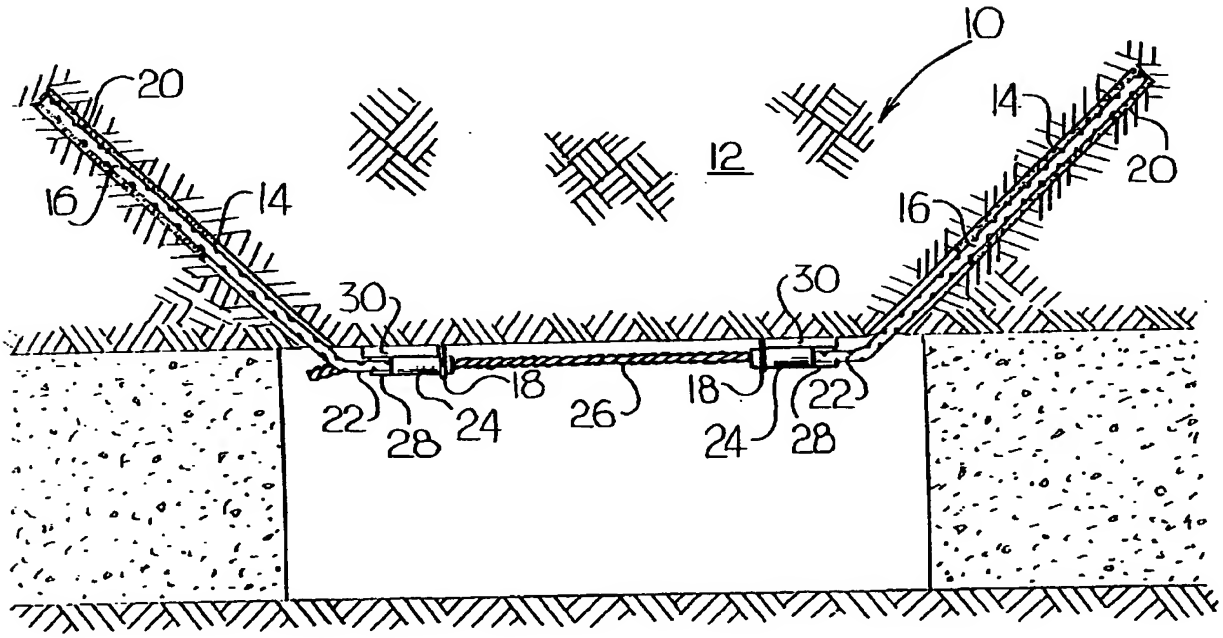
(51) Int.Cl.[7] E21D 23/00
(30) 1999/07/20 (60/144,672) US

(54) **ETAIS DE GALERIE DE MINE A BOULONS CINTRES**
(54) **MINE ROOF TRUSS WITH BENT ANGLE BOLTS**



(57) The present invention is a mine roof truss support system including a pair of bent angle bolts, a pair of splice tubes each individually connected to a corresponding bent angle bolt, a cable connected to each splice tube, and a pair of barrel and wedge assemblies, each individually connected to a corresponding opposite end of the cable, so that when the ends of the cable are pulled in one direction and the barrel and wedge assemblies are moved in an opposite direction, the mine roof truss support system is tensioned.

MINE ROOF TRUSS WITH BENT ANGLE BOLTS

ABSTRACT OF THE DISCLOSURE

The present invention is a mine roof truss support system including a pair of bent angle bolts, a pair of splice tubes each individually connected to a corresponding bent angle bolt, a cable connected to each splice tube, and a pair of barrel and wedge assemblies, each individually connected to a corresponding opposite end of the cable, so that when the ends of the cable are pulled in one direction and the barrel and wedge assemblies are moved in an opposite direction, the mine roof truss support system is tensioned.

MINE ROOF TRUSS WITH BENT ANGLE BOLTS

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to an underground mine roof supporting system and, more particularly, to a truss having bent angle bolts and a horizontal tying cable.

2. Brief Description of the Prior Art

Roof trusses or roof support systems for mines are well-known methods for providing support to the immediate roof strata. U.S. Patent Nos. 4,946,315 and 5,018,907 disclose typical roof truss systems utilizing interconnected tie rods extending between rigid roof bolts. The bolts are connected by means of a tie rod and tension is produced in the truss by a turnbuckle or the like. Tightening of the tie rod or turnbuckle can produce compressive forces in the rock of the roof which increases the strength of the rock. A variation of a mine roof truss formed from solid bolts is disclosed in U.S. Patent Nos. 5,193,940 and 5,238,329 which disclose mine roof trusses having angle bolts which are inserted into a bore hole and then formed at an angle below the mine roof to extend horizontally. Connecting members are positioned on the ends of the bent angle bolts and a tie rod extends between the connecting members. The horizontal ends of the angle bolts and the ends of the tie rod are threaded. Nuts are threaded onto the ends of the angle bolts and the tie rod and nuts are tightened against the connecting members to induce tension in the truss. The connecting members typically are solid bodies having holes drilled therethrough with beveled edges to allow the nuts to be partially received in the holes. These specialized connectors add significantly to the cost of the truss. In addition, the amount of tension applied to the truss is not known with much accuracy.

Another drawback to these rigid mine roof trusses is that the horizontal tie rod is difficult to handle underground, particularly, in mine passages with low seam height.

Accordingly, a need remains for a mine roof truss utilizing rigid angle bolts, but which is easier to install underground.

SUMMARY OF THE INVENTION

A mine roof truss of the present invention includes a first angle bolt and a second angle bolt. The first angle bolt has a first end extending into a first bore hole formed in a mine roof strata and a second end bent to an angle substantially horizontal to the mine roof strata. The second angle bolt has a third end extending into a second bore hole formed in the mine roof strata and a fourth end bent to an angle substantially horizontal to the mine roof strata.

A first splice tube is positioned adjacent the second end of the first angle bolt. A second splice tube is positioned adjacent the fourth end of the second angle bolt. The second end of the first angle bolt and the fourth end of the second angle bolt may each include a drivehead, wherein the first splice tube and the second splice tube each have a larger diameter than the driveheads. Alternatively, the second end of the first angle bolt and the fourth end of the second angle bolt can also be threaded, with a nut received by the second end of the first cable bolt and the fourth end of the second angle bolt. The first and second splice tubes preferably have a larger diameter than the nuts.

A cable, having a first end and a second end, extends between the first and second splice tubes. A first barrel and wedge assembly is positioned adjacent the first end of the cable and a second barrel and wedge assembly is positioned adjacent the second end of the cable. A first bearing plate may also be positioned between the first splice tube and the mine roof.

Tension is applied to the mine roof truss by urging the first barrel and wedge assembly against the first splice tube and pulling the first end of the cable in an opposite direction. Further tension can be applied to the mine roof

truss by urging the second barrel and wedge assembly against the second splice tube and pulling the second end of the cable in an opposite direction.

One method of installing a truss for supporting a mine roof includes the steps of:

(a) drilling a first bore hole and a second bore hole in a mine roof;

(b) inserting a first resin package into the first bore hole and a second resin package into the second bore hole;

(c) positioning a first splice tube adjacent the second end of the first angle bolt;

(d) positioning a second splice tube adjacent the fourth end of the second angle bolt;

(e) inserting a first end of a first angle bolt into the first bore hole bore;

(f) inserting a third end of a second angle bolt into the second bore hole;

(g) rotating the first angle bolt;

(h) rotating the second angle bolt;

(i) bending a second end of the first angle bolt in a position substantially parallel to the mine roof;

(j) bending a fourth end of the second angle bolt in a position substantially parallel to the mine roof;

(k) slidably attaching a first end of a cable to the first splice tube;

(l) slidably attaching a second end of the cable to the second splice tube;

(m) positioning a first barrel and wedge assembly adjacent the first end of the cable and a second barrel and wedge assembly adjacent the second end of the cable;

(n) pulling on the first end of the cable;

(o) moving the first barrel and wedge assembly in a direction toward the first splice tube;

(p) pulling on the second end of the cable;

(q) moving the second barrel and wedge assembly in a direction toward the first splice tube; and

(r) positioning a first bearing plate between the first splice tube and the mine roof.

The present invention is tensionable from both ends, is easier to install in cramped spaces than rigid bar type trusses, and can be tensioned with a greater degree of accuracy than rigid bar type trusses.

Further aspects of the invention are as follows:

A mine roof truss for supporting a mine roof strata comprising:

a first angle bolt having a first end extending into a first bore hole formed in the mine roof strata and a second end bent to an angle substantially horizontal to the mine roof strata;

a second angle bolt having a third end extending into a second bore hole formed in the mine roof strata and a fourth end extending into a first bore hole formed in the mine roof strata;

a first splice tube positioned adjacent said second end of said first angle bolt;

a second splice tube positioned adjacent said fourth end of said second angle bolt;

a cable, having a first end and a second end, extending horizontally between said splice tubes;

a first barrel and wedge assembly positioned adjacent said first end of said horizontal cable; and

a second barrel and wedge assembly positioned adjacent said second end of said horizontal cable.

A method of installing a truss for supporting a mine roof comprising the steps of:

(a) drilling a first bore hole and a second bore hole in a mine roof;

(b) inserting a first resin package into said first bore hole and a second resin package into said second bore hole;

(c) positioning a first splice tube adjacent a second end of a first angle bolt;

(d) positioning a second splice tube adjacent a fourth end of a second angle bolt;

(e) inserting a first end of said first angle bolt into said first bore

(f) inserting a third end of said second angle bolt into said second bore hole;

(g) rotating said first angle bolt;

(h) rotating said second angle bolt;

(i) bending said second end of said first angle bolt in a position substantially parallel to the mine roof;

(j) bending said fourth end of said second angle bolt in a position substantially parallel to the mine roof;

(k) slidably attaching a first end of a cable to said first splice tube;

(l) slidably attaching a second end of said cable to said second splice tube;

(m) positioning a first barrel and wedge assembly adjacent said first end of said cable and a second barrel and wedge assembly adjacent said second end of said cable;

(n) pulling on said first end of said cable; and

(o) moving said first barrel and wedge assembly in a direction toward said first splice tube.

A complete understanding of the invention will be obtained from the

following description when taken in connection with the accompanying drawing figures wherein like reference characters identify like parts throughout.

These and other advantages of the present invention will be clarified in the Detailed Description of the Preferred Embodiment taken together with the attached drawings in which like reference numerals represent like elements throughout.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a side view of the mine roof truss installed in a mining chamber according to the present invention; and

Fig. 2 is a plan view of the splice tube used in the truss illustrated in Fig. 1 with ends of a bolt, a cable, and a bearing plate installed therewith.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

For purposes of the description hereinafter, the terms "upper", "lower", "right", "left", "vertical", "horizontal", "top", "bottom" and derivatives thereof shall relate to the invention as it is oriented in the drawing figures. However, it is to be understood that the invention may assume various alternative variations and step sequences, except where expressly specified to the contrary. It is also to be understood that the specific devices and processes illustrated in the attached drawings, and described in the following specification, are simply exemplary embodiments of the invention. Hence, specific dimensions and other physical characteristics related to the embodiments disclosed herein are not to be considered as limiting.

Fig. 1 schematically illustrates a mine roof truss 10 for supporting the roof strata 12 of a mine. The truss 10 includes a pair of spaced apart bore holes 14 drilled into the roof strata 12. The bore holes 14 may extend substantially vertically into the roof strata at an angle thereto, as shown in Fig. 1, as is well-known in the art. A rigid bolt 16, preferably formed from rebar and having a drivehead 18 is secured

within each bore hole 14 by a cured resin mixture 20. Alternatively, the bolt 16 may have a threaded end onto which a nut or other drivehead is threaded instead of the drivehead 18.

During installation, the resin 20 is normally forced in the bore hole 14 before the bolt 16. The bolt 16 is advanced and rotated, rupturing the resin packages and mixing the resin during the installation procedure. The advancing and rotation of the bolt 16 is accomplished by engaging the drivehead 18 with appropriate bolting equipment. Following the mixing of the resin 20, the resin 20 is allowed to cure securing the leading end of the bolt 16 within the bore hole 14.

An exposed end 22 of the bolt 16 extends from the bore hole 14. After the resin 20 has set, the mine roof bolting equipment is used to apply pressure to the exposed end 22 to bend the exposed end 22 as shown in Fig. 1 such that a substantial portion of the exposed end 22 extends substantially parallel to the mine roof strata.

A splice tube, such as disclosed in U.S. Patent No. 5,836,720, is positioned on each of the exposed end portions 22. When the bolt 16 includes a drivehead 18, the splice tube 24 is slipped over the opposite end of the bolt 16 before the bolt is inserted into the bore hole. Alternatively, as described above, the exposed end 22 of the bolt 16 may be threaded and the splice tube 24 may be slipped over the exposed end after

installation of the bolt and a nut (not shown) may be threaded onto the exposed end 22. The integral drivehead 18 or a nut threaded onto the exposed end 22 prevents the splice tube 24 from slipping off the exposed end 22 of the bolt 16.

Preferably, the splice tube 24 is formed of an elongated conduit between a pair of spaced ends. The conduit receives the exposed end 22 of the bolt 16 therethrough. The drivehead 18 has a diameter larger than the inner dimensions of the conduit of the splice tube such that the drivehead 18 abuts one end of the splice tube 24.

A horizontal cable 26 extends between the splice tubes 24. The horizontal cable 26 is attached to the splice tube 24 via a barrel and wedge assembly 28 mounted on each end thereof, as shown in Fig. 2. The ends of the horizontal cable 26 extend beyond the barrel and wedge assemblies 28. At least one end and preferably both ends of the horizontal cable 26 extends beyond the barrel and wedge assembly 28 adjacent thereto by about one to two feet. The longer ends of the horizontal cable 26 are used for gripping the cable 26 to induce tension in the truss. A hydraulic tensioner or other hydraulic jacking device is used to exert tension in the truss by pulling on the horizontal cable 26 in a direction away from the corresponding splice tube 24 and urging the corresponding barrel and wedge assembly 28 towards the corresponding splice tube 24.

The truss 10 may be installed with a pair of bearing plates 30 each positioned between a splice tube 24 and the mine roof as shown in Fig. 1.

The mine roof truss of the present invention is easier to handle underground in mine passageways than the conventional trusses utilizing rigid tie rods. In addition, the truss of the present invention uses relatively simple components. The splice tube, horizontal cable, and barrel and wedge assemblies are presently commonly used in mine roof support. Because the truss is tensioned with a hydraulic tensioning unit, the amount of tension applied to the truss can be specifically determined.

The invention has been described with reference to the preferred embodiment. Obvious modifications and alterations will occur to others upon reading and understanding the preceding detailed description. It is intended that the invention be construed as including all such modifications and alterations insofar as they come within the scope of the appended claims or the equivalents thereof.

I CLAIM:

1. A mine roof truss for supporting a mine roof strata comprising:

a first angle bolt having a first end extending into a first bore hole formed in the mine roof strata and a second end bent to an angle substantially horizontal to the mine roof strata;

a second angle bolt having a third end extending into a second bore hole formed in the mine roof strata and a fourth end extending into a first bore hole formed in the mine roof strata;

a first splice tube positioned adjacent said second end of said first angle bolt;

a second splice tube positioned adjacent said fourth end of said second angle bolt;

a cable, having a first end and a second end, extending horizontally between said splice tubes;

a first barrel and wedge assembly positioned adjacent said first end of said horizontal cable; and

a second barrel and wedge assembly positioned adjacent said second end of said horizontal cable.

2. The mine roof truss as claimed in claim 1 further comprising a first bearing plate positioned between said first splice tube and the mine roof.

3. The mine roof truss as claimed in claim 1 wherein tension is applied to said mine roof truss by urging said first barrel and wedge assembly against said first splice tube and pulling said first end of said cable in an opposite direction.

4. The mine roof truss as claimed in claim 3 wherein tension is applied to said mine roof truss by urging said second barrel and wedge assembly against said second splice tube and pulling said second end of said cable in an opposite direction.

5. The mine roof truss as claimed in claim 1 wherein said second end of said first angle bolt includes a drivehead.

6. The mine roof truss as claimed in claim 5 wherein said fourth end of said second angle bolt includes a drivehead.

7. The mine roof truss as claimed in claim 5 wherein said first splice tube has a larger diameter than said drivehead.

8. The mine roof truss as claimed in claim 6 wherein said second splice tube has a larger diameter than said drivehead.

9. A method of installing a truss for supporting a mine roof comprising the steps of:

(a) drilling a first bore hole and a second bore hole in a mine roof;

(b) inserting a first resin package into said first bore hole and a second resin package into said second bore hole;

(c) positioning a first splice tube adjacent a second end of a first angle bolt;

(d) positioning a second splice tube adjacent a fourth end of a second angle bolt;

(e) inserting a first end of said first angle bolt into said first bore hole bore;

(f) inserting a third end of said second angle bolt into said second bore hole;

(g) rotating said first angle bolt;

(h) rotating said second angle bolt;

(i) bending said second end of said first angle bolt in a position substantially parallel to the mine roof;

(j) bending said fourth end of said second angle bolt in a position substantially parallel to the mine roof;

(k) slidably attaching a first end of a cable to said first splice tube;

(l) slidably attaching a second end of said cable to said second splice tube;

(m) positioning a first barrel and wedge assembly adjacent said first end of said cable and a second barrel and wedge assembly adjacent said second end of said cable;

(n) pulling on said first end of said cable; and

(o) moving said first barrel and wedge assembly in a direction toward said first splice tube.

10. The method of installing a truss for supporting a mine roof as claimed in claim 9 further comprising the steps of:

(p) pulling on said second end of said cable; and

(q) moving said second barrel and wedge assembly in a direction toward said first splice tube.

11. The method of installing a truss for supporting a mine roof as claimed in claim 9 further comprising the step of:

(r) positioning a first bearing plate between said first splice tube and the mine roof.

12. The method of installing a truss for supporting a mine roof as claimed in claim 10 further comprising the step of:

(s) positioning a first bearing plate between said first splice tube and the mine roof.

13. The method of installing a truss for supporting a mine roof as claimed in claim 9 wherein said second end of said first angle bolt further comprises a drivehead.

14. The method of installing a truss for supporting a mine roof as claimed in claim 13 wherein said fourth end of said second angle bolt further comprises a drivehead.

15. The method of installing a truss for supporting a mine roof as claimed in claim 13 wherein said first splice tube has a larger diameter than said drivehead.

16. The method of installing a truss for supporting a mine roof as claimed in claim 14 wherein said second splice tube has a larger diameter than said drivehead.

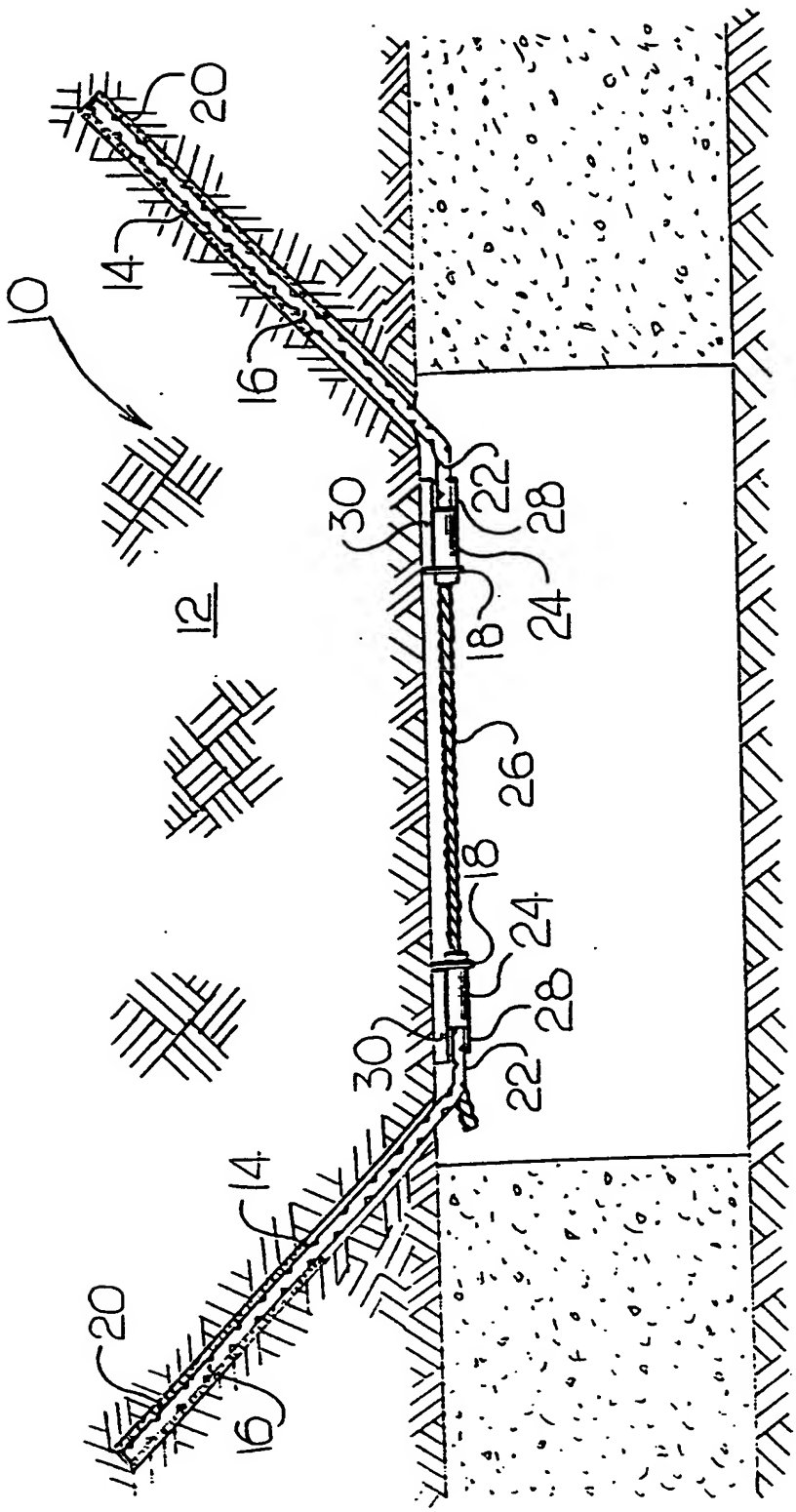


Fig. 1

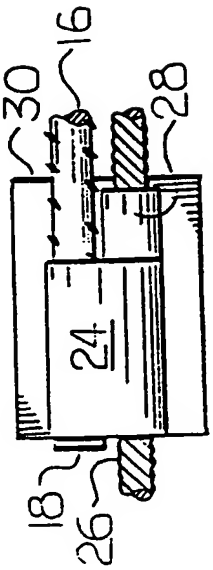
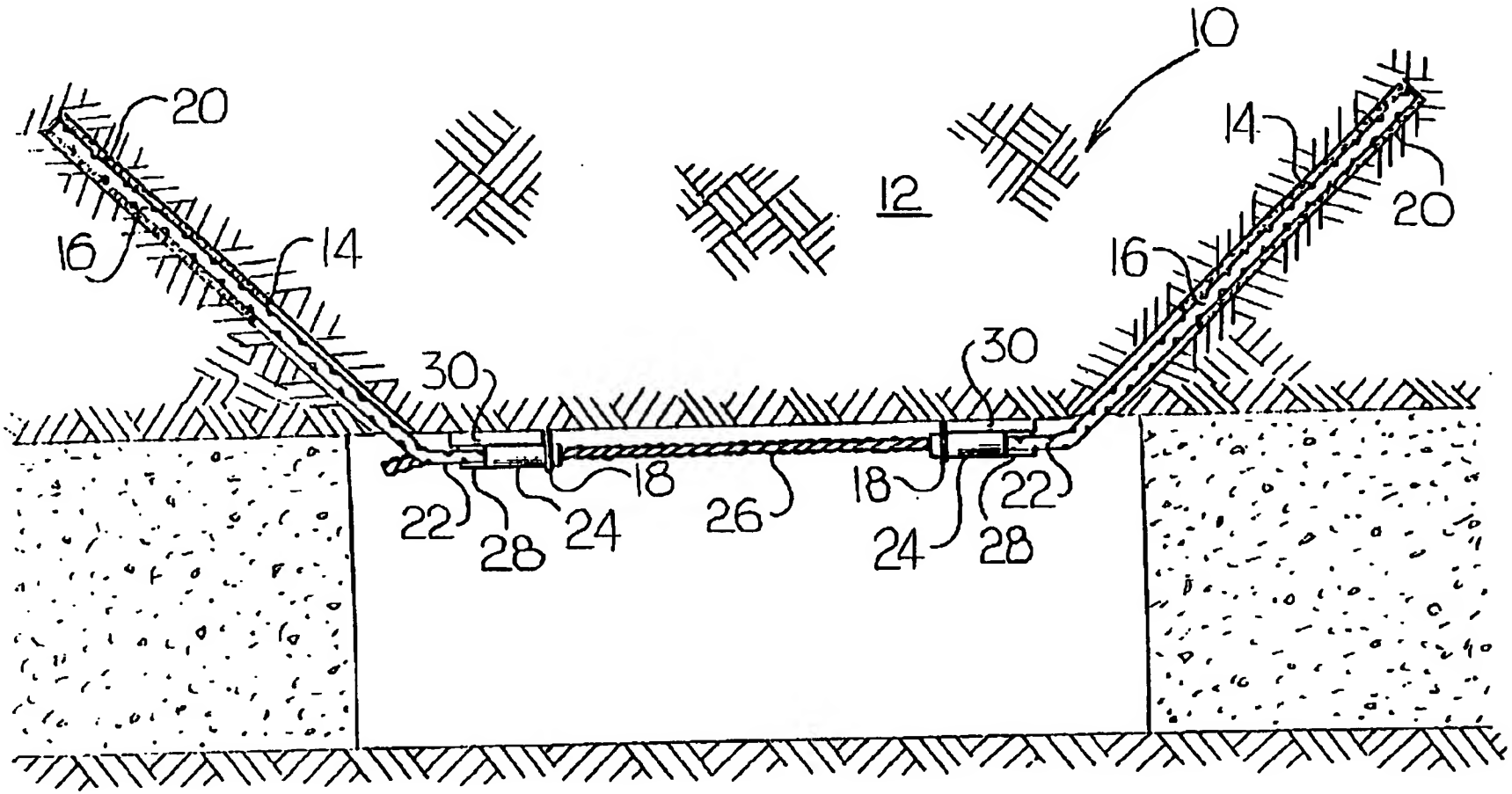


Fig. 2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